What is claimed is:

1. An oscillating piston machine, comprising a housing (12) which has an essentially spherical housing inner wall, four pistons (32-38) which rotate together about an axis (40) of rotation which is approximately in the center of the housing being arranged in the housing (12), in which case, of the four pistons (32-38), in each case two pistons which are approximately diametrically opposite one another with respect to the center of the housing form a rigid piston pair (32/36, 34/38), the two piston pairs (32/36, 34/38) being capable of pivoting to and fro in opposite directions about a common pivot axis (42) which runs approximately perpendicularly with respect to the axis (40) of rotation, the two piston pairs (32/36, 34/38) being arranged in criss-cross fashion with respect to the pivot axis (42) in such a way that in each case two pistons of the two piston pairs (32/36, 34/38) have their piston working faces (32a, 34a, 36a, 38a) opposite one another in order to form a working chamber (48, 50) between them, each piston pair (32/36, 34/38) having a bearing section (52, 56) for mounting the piston pair (32/36, 34/38) on the pivot axis (42), and in each case a side wall section (54, 55, 58) for each piston of the piston pair (32/36, 34/38), for laterally delimiting one of the working chambers (48, 50) in each case, characterized in that the bearing section (52, 56) and the side wall sections (54, 55, 58) are constructed integrally with one another and are arranged on the same side of the respective piston pair (32/36, 34/38).

2. The oscillating piston machine of claim 1, characterized in that the bearing section (52, 56) extends in the direction of the pivot axis (42), over approximately half the width of the piston pair (32/36; 34/38) in the direction of the pivot axis (42).

3. The oscillating piston machine of claim 1 or 2, characterized in that the respective side wall section (54, 55, 58) extends on the bearing section (52,

56) so as to curve concavely from the outside to the inside and from the top to the bottom.

4. The oscillating piston machine of claim 3, characterized in that the respective side wall section (54, 55, 58) extends in the direction of the pivot axis (42) over the entire length of the bearing section (52, 56).

5. The oscillating piston machine of anyone of claims 1 through 4, characterized in that each piston (32-38) has, at its end opposite the side wall section (54, 55, 58), a side face whose shape is matched to the side wall section (54, 55, 58) of that piston together with which this piston forms the respective working chamber (48, 50).

6. The oscillating piston machine of anyone of claims 1 through 5, characterized in that each individual piston (32-38) extends approximately 90° about the axis (40) of rotation.

7. The oscillating piston machine of anyone of claims 1 through 6, characterized in that a ratio between a dimension (b) of each piston (32-38) in the direction of the pivot axis (42) and a dimension (h) of each piston (32-38) transversely with respect to the pivot axis (42) is in the range from approximately 1.5 : 1 to 2.5 : 1, preferably 2.2 : 1.

8. The oscillating piston machine of anyone of claims 1 through 7, characterized in that a maximum angle (α) of aperture of the working chambers (48, 50) about the pivot axis (42) is in the range from approximately 40° to approximately 60°.

9. The oscillating piston machine of anyone of claims 1 through 8, characterized in that the two piston pairs (32/36, 34/38) are seated with their

bearing sections (52, 56) on a journal (64) which forms the pivot axis (52), and wherein in each case an end element (68, 70) which is in the form of a spherical cap and which holds the piston pairs (32/36; 34/38) against one another in the direction of the pivot axis (42) is arranged at the ends of the journal (64).

10. The oscillating piston machine of claim 9, characterized in that the end element (68, 70) which is in the form of a spherical cap extends approximately 90° about the axis (40) of rotation.

11. The oscillating piston machine of claim 9 or 10, characterized in that the end element (68, 70) which is in the form of a spherical cap extends approximately 90° about an axis which is perpendicular with respect to the axis (40) of rotation and to the pivot axis (42).

12. The oscillating piston machine of anyone of claims 9 through 11, characterized in that the pistons (32-38) are connected to at least one output shaft (72, 74) which can rotate about the axis (40) of rotation and which ends at the piston end in a first fork section (76, 78) outside the pivot axis (42), which section is arranged with its two end sections (80-86) between the end elements (68, 70) and is directly connected to them in a releasable fashion.

13. The oscillating piston machine of claim 12, characterized in that the end sections (80-86) of the first fork section (76, 78) have a positively locking connection to the end elements (68, 70).

14. The oscillating piston machine of claim 12 or 13, characterized in that the end sections (80-86) of the first fork section (76, 78) widen starting from the output shaft (72, 74) to their outer end.

15. The oscillating piston machine of anyone of claims 12 through 14, characterized in that a ratio between the dimension (B_1) of the fork section (76, 78) in the direction perpendicular to the pivot axis (42) in its center with respect to the corresponding dimension (B_2) of the fork section (76, 78) at its ends is in the range from approximately 1 : 1.5 to 1 : 2.5, preferably approximately 1 : 2.

16. The oscillating piston machine of anyone of claims 12 through 15, characterized in that a ratio between the dimension (B_2) of the fork section (76, 78) in the direction perpendicular to the pivot axis (42) at its ends with respect to the dimension (B_3) of the fork section (76, 78) in the direction of the pivot axis (42) is in the range from approximately 1 : 2 to approximately 1 : 4, preferably approximately 1 : 1.375.

17. The oscillating piston machine of anyone of claims 12 through 16, characterized in that a ratio of the thickness (D) of the fork section (76, 78) in the region of the output shaft (64) with respect to the dimension (B_3) of the fork section (76, 78) in the direction of the pivot axis (42) is in the range from approximately 1 : 2 to 1 :4, preferably approximately 1 : 2.75.

18. The oscillating piston machine of anyone of claims 12 through 17, characterized in that a second fork section (78) which is essentially identical in shape and which is also connected to the end elements in a releasable fashion is arranged opposite the first fork section (76).

19. The oscillating piston machine of claim 18, characterized in that the second fork section (78) has a further output shaft (74).

20. The oscillating piston machine of anyone of claims 12 through 19, characterized in that the first and/or second fork sections (76, 78)

extend/extends approximately 90° about an axis which is perpendicular with respect to the axis (40) of rotation and with respect to the pivot axis (42) and are/is in the form of a spherical surface on the outside.

21. The oscillating piston machine of anyone of claims 12 through 20, characterized in that one side of the first and/or second fork section (76, 78) which faces piston rear side faces of the pistons (32-38) is constructed so as to curve in a fashion which is essentially complementary to the piston rear side faces.

22. The oscillating piston machine of anyone of claims 12 through 21, characterized in that admission pressure chambers and/or cooling chambers are constructed between the piston rear side faces and the corresponding facing side of the fork section or fork sections (76, 78).

23. The oscillating piston machine of anyone of claims 1 through 22, characterized in that each piston (32-38) has a running roller (108-114) whose roller axis is inclined at an angle of approximately 30° to 50°, preferably approximately 35°, with respect to the piston working face.

24. The oscillating piston machine of claim 23, characterized in that the running rollers (108-114) are of conical construction, an imaginary prolongation of each cone resulting in a cone tip which is at the center point of the housing.